

# Obesity-related Metabolic Comorbidities Remission in Postbariatric Surgery Patients

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## ABSTRACT

**Introduction:** Obesity-related diseases (ORD) are associated with a decrease in the quality of life and life expectancy of patients. The remission of these pathologies after bariatric surgery is not the same in all patients.

**Objectives:** To evaluate the remission of the principal ORD in patients who underwent bariatric surgery.

**Materials and methods:** Retrospective analysis of patients with morbid obesity and ORD (hypertension, diabetes mellitus, dyslipidemia or obstructive sleep apnea and hypoapnea syndrome) who received bariatric surgery between January 2014 and January 2016. Patients had two surgical options: Laparoscopic sleeve gastrectomy (LSG) or laparoscopic Roux-en-Y gastric bypass (LRYGB). Follow-up was performed after 1, 6, and 12 months per the first year after surgery, recording data, such as percentage of excess weight lost (%EWL), percentage of total body weight lost, and partial or total ORD remission.

**Results:** Out of a total of 23 patients, 52% (12) were females and the average age was  $44 \pm 13$  years, 17 (74%) received LSG and 6 (26%) LRYGB. The average initial body mass index was  $43 \pm 4.3$  kg/m<sup>2</sup>, the %EWL at 1, 6, and 12 months was  $35.4 \pm 15.2$ ,  $62.5 \pm 17.5$ , and  $79.1 \pm 20.2$  respectively. Comorbidities remission was found in 95.6% of patients (22), partial resolution in 32%, and complete in 68%. A total of 52.1% of remissions were reported in the first month postsurgery.

**Conclusion:** Bariatric surgery has proved to be the most effective method for reducing and sustaining weight loss in the long-term and comorbidities remission. A decrease of 50% of EWL has a positive impact in terms of discontinuing medications and normalizing the patient's biochemical profile.

**Keywords:** Bariatric surgery, Gastric bypass, Laparoscopic Roux-en-Y, Laparoscopic sleeve gastrectomy, Obesity, Obesity-related disease, Remission.

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## INTRODUCTION

Obesity is a pandemic that affects 1.7 billion people.<sup>1</sup> Obesity is closely related to metabolic disease, which is defined as the presence of hypertension, type II diabetes, and hyperlipidemia, increased risk of cardiovascular disease, osteoarticular symptoms, and obstructive sleep apnea and hypopnea syndrome (OSAHS); all these obesity-related diseases (ORD) result in a decrease in patients' life expectancy of up to 10 to 20 years.<sup>1-4</sup>

In Colombia in 2014, 51% of the population were overweight or morbidly obese and one out of every two Colombians is now suffering as a consequence of this excess body weight. In June 2015, 10% of the Colombian population had diabetes and obesity, and 25% of the population had hypertension.<sup>5</sup>

Research has shown that a decrease in body weight of 10 kg can lead to improvements in the effects of comorbid conditions associated with obesity.<sup>6</sup> It is for this reason that bariatric surgery has proved to be an effective treatment with long-term results in terms of improving and resolving the problems associated with comorbid conditions in individuals with obesity. This surgery positively impacts on life expectancy. A decrease of 10% of a patient's excess weight, therefore, has an impact on the quality of life of the patient.<sup>6</sup>

In a cohort study, bariatric surgery decreased excess weight by 67.1%, with a significant reduction in the relative risk of cardiovascular disease, in the risk of endocrine, respiratory, and infectious problems, and in cancer related to obesity and psychiatric care. Additionally, bariatric surgery reduced the risk of mortality by 89% and produced a 71.6% improvement in quality of life.<sup>6</sup>

It is also well known that ORD has negative economic impacts within the health system.<sup>4</sup> From 2 to 8% of insurance costs are due to the management of ORD.<sup>4</sup> There is also a huge annual cost in terms of medications prescribed for controlling the effects of ORD.<sup>7</sup>

It has been demonstrated, in numerous articles, that both the laparoscopic sleeve gastrectomy (LSG) and

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laparoscopic Roux-en-Y gastric bypass (LRYGB) are equally effective in the management of obesity, for the resolution of comorbidities, or in terms of influencing the course of the chronicity of diseases.<sup>8</sup>

The impact of bariatric surgery on the health system is significant because once a patient's excess body weight is removed, between 97 and 98% of their comorbidities are resolved. This translates into fewer medical visits, decreased or absent need for medications, and fewer complications from chronic diseases, which means a decrease of up to 50% in the demands on the health insurance system.<sup>4</sup>

In the USA, in 2008, 9.1% of the health care budget was allocated to the management of comorbidities in patients with morbid obesity. The discrimination individuals with obesity experience is also significant, in terms of accessing employment.<sup>9</sup> Hawkins et al<sup>10</sup> showed that after a bariatric surgery, 32% of patients managed to find a job or improved their current employment conditions.

## MATERIALS AND METHODS

After approval by the Institutional Review Board (IRB) and in accordance with requirements for submission of the International Committee of Medical Journal Editors, this study was performed. Data of all patients with documented ORD who were admitted in the institution with a body mass index (BMI) of 35 to 50 kg/m<sup>2</sup>, according to the American Society for Metabolic Bariatric Surgery (ASMBS) guide, were prospectively collected. All the patients were assessed and managed by a multidisciplinary group for clinical obesity, and according to their comorbidities, food habits, and their risk of regaining weight, the patients were evaluated by a board of specialists and the best procedure was chosen for each patient. The surgical alternatives were LSG and LRYGB; the choice of one or the other was made using the criterion of the surgeon and board. Data were collected as patient's follow-up, including initial BMI, the patient's ideal weight, and the comorbidities associated with obesity, such as hypertension, type I and II diabetes, hyperlipidemia, OSAHS, and osteomuscular diseases.

The surgical techniques used were the following: *LSG*: In the French position, using a 5 trocar technique, two 12 mm umbilical and left paraumbilical, and three 5 mm right paraumbilical, left low costal border, and subxiphoid; traction of the left hepatic lobe; with an ultrasonic scalpel, the major curve was released until the left crura and 6 cm from the pylorus to the antrum. A 36 F bougie was used for calibration, and the tubulization was initiated with 5 cartridges 60 mm Echelon Johnson and Johnson staples, first green and the rest blue. The staple

line was subsequently reinforced with PDS 2/0 and all of them underwent an air leak test. Finally, closure of the ports of 12 mm with endoclose needle and prolene 1/0 was performed. No drains were left routinely.

*LRYGB*: In the French position, technique with five trocars, three 12 mm: Umbilical and bilateral paraumbilical and 2 of 5 mm: Left costal margin and subxiphoid. The first step is to create the gastric pouch, below the third gastric vessel, and the space dissection was performed with an ultrasonic scalpel and the back face of the stomach was dissected and the first cartridge of 45 mm blue was fired; it subsequently passed the 36 F bougie and two shots were performed with 45 mm blue cartridge. The transverse colon was lifted to identify the Treitz ligament and, at 70 cm, the first jejunostomy was performed with a white cartridge of 45 mm for biliopancreatic limb. Next, the 120 cm was measured for the alimentary limb and the Roux-in-Y laterolateral was performed with a 45 mm cartridge with a distal closure with vicryl 3/0. In all patients, the meso was closed with vicryl 3/0 to avoid internal hernias. Last step, laterolateral gastrojejunal anastomosis with a 45 mm blue cartridge, an air test leak was performed and closing the 12 mm ports with endoclose needle and 1/0 prolene; no drain left.

Routinely we did not order barium studies. Discharge was given 1 day after the procedure and patients began hypoglycemic half portion clear liquids per day 4; then they turned to liquid diet.

In order to classify each patient according to their comorbidity, and to attempt to achieve the remission of these comorbidities, the following definitions were used:

- Arterial hypertension was defined as systolic pressure > 140 and/or diastolic pressure > 90, or the use of antihypertensive agents.
- Diabetes is diagnosed with a fasting glycemia > 126 mg/dL, > 200 mg/dL 2 hours after a glucose load, or the use of hypoglycemic agents/insulin.
- Hyperlipidemia is defined as a lipid profile of high-density lipoproteins (HDL) < 40 mg/dL for men and < 50 mg/dL in women and/or triglycerides > 150 and/or low-density lipoproteins (LDL) > 100 mg/dL, or the use of medications to decrease lipids.
- The diagnosis of OSAHS was based on repeated episodes of occlusion of the respiratory tract, greater during sleep, or whilst the patient is awake and a high rate of apnea/hypopnea evidenced in the polysomnogram or if a continuous positive airway pressure (CPAP) was needed whilst the patient was asleep.<sup>6,11</sup> The criteria for remission are the following:
- Diabetes, according to the American Diabetes Association definition, which defines partial remission as a fasting glycemia < 126 and glycosylated Hb < 7 for 1 year without medication, complete remission as a

glycemia < 100, and glycosylated Hb < 6.5 for a year without medication.<sup>8</sup>

- In hypertension, remission refers to the nonuse of medication and normal levels of pressure or a decrease in the amount/frequency of use of antihypertensive agents.<sup>12</sup>
- In sleep apnea, no use of CPAP.
- Hyperlipidemia in the absence of medication and normal lipid profile values. Another form of definition for the comorbidities was according to the available descriptions in their prior medical histories.

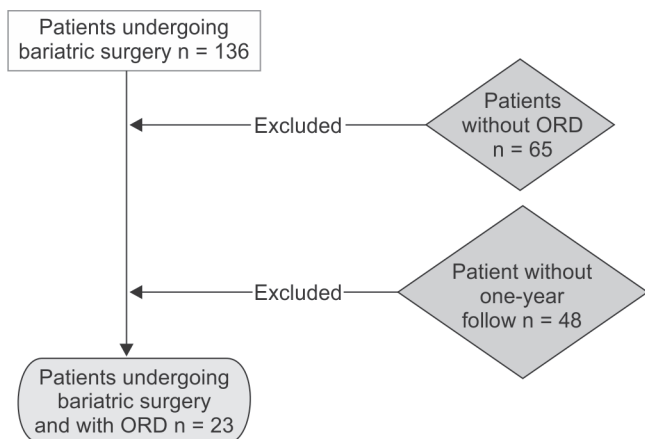
A postsurgical control was performed after 1 week, then 1st, 3rd, 6th, and 12th month postoperative, with the following data being taken: Percentage of weight lost compared with the total body weight, the %EWL and whether or not there was any remission in any of the comorbidities. The categorical variables were represented with numeric proportions and with medium and standard deviations.

**RESULTS**

The records of 136 patients who received bariatric surgery were included between January 2014 and January 2016; the patients who did not suffer comorbidities associated with obesity and who did not complete 1-year follow-up were excluded. Twenty-three patients with comorbidities, as documented in their medical records, were included (Flow Chart 1).

The patients' mean age was 44 ± 13 years; 52% (12) were women; 17 (74%) received their bariatric surgery via LSG and 6 (26%) via LRYGB; 16 (69.5%) patients suffered from hypertension; 9 (39%) patients had OSAHS; 11 (48%) patients had hyperlipidemia; 5 (22%) had other comorbidities, such as osteoarthritis; and hyperuricemia in 2 (9%) patients (Table 1). The average initial BMI was 43 ± 4.3 kg/m<sup>2</sup>. No mortality or associated complications were documented for the procedure in this group of patients. The remission rate was 95.6% (22) of patients and was partial and complete in 32 and 68% of patients respectively.

**Flow Chart 1:** Flow diagram



**Table 1:** Characteristics of baseline patients

	Patients n = 23
Age, average ±	44 ± 13
Gender, n (%)	
Male	11 (48)
Female	12 (52)
Comorbidities n (%)	
Hypertension	16 (69.5)
OSAHS	9 (39.1)
Hyperlipidemia	11 (48)
Diabetes mellitus	5 (22)
Others	2 (9)
Presurgical BMI (%), average ±	42.9 ± 4.3
Type of procedure, n (%)	
Sleeve	17 (74)
Bypass	6 (26)
Rate of complications	0 (0)
Total length of hospital stay, median (IQR)	3 [1–6]
Mortality	0 (0)
Comorbidities remission, n (%)	22 (95.6)
Partial remission	7 (32)
Complete remission	15 (68)

OSAHS: Obstructive sleep apnea/hypopnea syndrome

The %EWL at 1, 6, and 12 months was 35.4 ± 15.2, 62.5 ± 17.5, and 79.1 ± 20.2 respectively. With a weight loss of 14.4 ± 5.3% and comorbidities remission in 52.1% of patients, whether partial or complete, in the 1st month (Table 2).

Partial or total ORD remissions are summarized in Table 3.

**DISCUSSION**

Bariatric surgery is the most effective procedure for the management of morbid obesity and the total or partial resolution of its associated metabolic comorbidities. Both

**Table 2:** Follow-up time and weight loss percentage

	1 month	6 months	1 year
Weight lost (kg), average ± SD	17.3 ± 8.6	30.4 ± 10.8	38 ± 14.2
Excess weight loss (%EWL)	35.4 ± 15.2	62.5 ± 17.5	79.1 ± 20.2
Weight loss percentage (%), average ± SD	14.4 ± 5.3	25 ± 6.6	31.6 ± 7.9
Comorbidities remission, n (%)	12 (52.1)	9 (39.1)	1 (4.3)

SD: Standard deviation

**Table 3:** Partial or total remission per comorbidity

Comorbidities remission	Partial remission n = 7	Total remission n = 15
Hypertension, n = 16	7 (44)	9 (56)
OSAHS, n = 9	5 (55.5)	4 (44.4)
Hyperlipidemia, n = 10	4 (40)	6 (60)
Diabetes mellitus, n = 5	3 (60)	2 (40)

OSAHS: Obstructive sleep apnea/hypopnea syndrome





procedures proved equally effective in the resolution of comorbidities and the weight loss.<sup>13</sup>

This change, both in weight and comorbidities, directly impacts mortality, with a decrease between 29 and 40% and with improvements in terms of life expectancy.<sup>14</sup> We know that obesity accounts for between 2 and 7% of the overall health costs of a country, which can translate, in the USA, into 100 billions of dollars each year. Bariatric surgery is a cost-effective method to decrease the costs related to the management of obesity.<sup>15,16</sup>

A factor that affects patient outcome is the different processes of authorization of the insurers. Flanagan et al<sup>17</sup> performed a study comparing the mortality of patients whose insurers, after being approved by the multidisciplinary group, either approved or denied the procedure. The study showed that the mortality of the control group was 6% compared with the study group, favoring bariatric surgery for the resolution of the patients' comorbidities and increasing their life expectancy.

This same analysis was done in Europe; in France, there was a decline of 5% in terms of the overall cost for the patients operated on during the first 2 years of postbariatric surgery, which has a positive impact on the reduction of their medical expenses and the number of medical visits.<sup>18</sup>

As to whether there were any differences in the metabolic impact and the type of surgery for weight reduction, Zhang et al<sup>11</sup> showed that both have a positive impact on weight reduction and improving the patient's comorbidities. The results obtained for the two different types of surgeries were not very different from one another, although it is known that the sleeve type of surgery is considered a better option for the management of diabetes; it has been shown that there are particular benefits in terms of the resolution of type II diabetes with this type of surgery.<sup>19</sup> This type of surgery has also been shown to produce improvement in the patients' total cholesterol and their LDL, although the sleeve type of surgery improves the patients' triglycerides and increases their levels of HDL.<sup>19,20</sup>

Hepatic steatosis is a disease frequently found in patients with morbid obesity and is one of the main causes of chronic liver disease, such as steatohepatitis, chronic inflammation, cirrhosis, and eventually hepatocellular carcinoma. Hepatic steatosis makes up part of the metabolic diseases that are related to insulin resistance. Currently, the use of ultrasonography has facilitated the early diagnosis of this pathology, but it is clear that a decrease of 50% EWL leads to the resolution of this pathology.<sup>21</sup>

In a meta-analysis, Buchwald showed that remission of hypertension is not dependent on the type of procedure, but rather that the number of antihypertensive drugs a patient was taking before or around the time

of the surgery defines a patient's total or partial remission.<sup>22-24</sup> A Swedish study showed more benefits with the bypass, although it is worth mentioning that this study did not include the gastric sleeve.<sup>13</sup>

Bariatric surgery has proved to be the most effective treatment in management of metabolic syndrome.<sup>25</sup> A decrease of more than 50% of the patient's excess weight has a significant impact on the resolution of this pathology and the type of surgery undertaken does not affect this result; in our cohort, there was a loss of 30% of the patient's excess weight in the 1st month, leading to a significant improvement of their metabolic syndrome. During the year of the patients' follow-up, a resolution of their metabolic symptoms was found in 92% of patients.<sup>21,22</sup> The inability of patients to attend their follow-up appointments was one of the difficulties of this study; monitoring and follow-up of patients for 1 year or more is hampered by insurers.

In terms of pharmacoeconomics, this indicates that there is a decrease of up to 82% of the costs associated with the management and treatment of comorbidities secondary to obesity, in relation to the overall cost of the surgery; this is small with regards to the social impact this brings to the patient.<sup>16</sup>

## CONCLUSION

Bariatric surgery is an excellent tool for the management of metabolic disease, as our study showed a resolution of up to 92% and a weight decrease of more than 70%, which is consistent with previously published studies. The impact of these results on the patient is translated into an improvement in the quality of their daily lives (such as their working conditions). It also produces a positive impact in terms of reduction in the use of health services, both medication usage and medical visits. This translates to savings of millions of pesos in health care costs. It is very important to bear in mind that a change of habits, in patients, is fundamental in order to achieve these results and to keep their weight down in the long-term.

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